REMARKS

Claims 1-4 and 18-29 are pending in the present application, claims 5-17 having been canceled by a previous amendment. The Applicants have carefully reviewed the September 15, 2004 Office Action and respond as follows:

Filing of a Substitute Specification

The applicants are filing herewith a substitute specification in accordance with 37 C.F.R § 1.125 in order to correct problems concerning idiomatic English. The substitute specification also includes amendments to the specification made in the Preliminary Amendment. The Applicants' attorney discussed the filing of a substitute specification with Examiner Yeung on November 16, 2004 and he gave his approval.

The substitute specification being filed herewith contains no new matter in accordance with 37 C.F.R § 1.125.

Applicants are also submitting herewith a marked-up copy of the substitute specification showing all of the changes relative to the version of the specification filed with the application. In addition, the Applicants have corrected some typographical errors.

Claim Rejections - 35 USC § 112

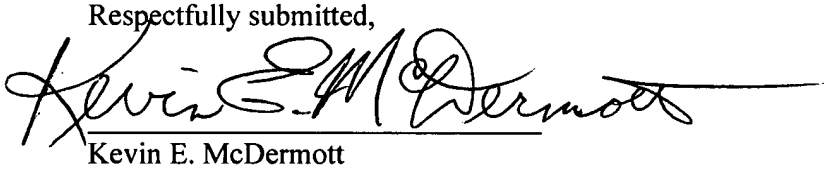
Claims 1-4 and 18-29 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and definitely claim the subject matter which Applicants regard as their invention. The Applicants have amended the claims to correct the deficiencies pointed out by the Examiner.

Allowable Subject Matter

In the September 15, 2004 Office Action, the Examiner indicated that pending claims 1-4 and 18-29 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, second paragraph, set forth in the Office Action. The Applicants have amended the claims in accordance with the Examiner's comments and believe that they are now in proper condition for allowance.

If the Examiner has any questions or comments relating to the present application, he is respectfully invited to contact Applicants' attorney at the telephone number set forth below.

Respectfully submitted,



Kevin E. McDermott
Registration No.: 35,946
Attorney for Applicants

HOFFMANN & BARON, LLP
6900 Jericho Turnpike
Syosset, New York 11791
(516) 822-3550

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OPTICAL APPARATUS

[001] This application claims priority based on an International Application filed under the Patent Cooperation Treaty, PCT/DE00/01778 , filed on May 26, 2000, and German Application No. 199 24 783.8, filed on May 29, 1999.

BACKGROUND OF THE INVENTION

[002] The invention concerns a diffractively and/or refractively operating optical apparatus for passing incident light, preferably sunlight, on to a receiver, preferably on to a solar ~~element, comprising~~ element. The optical apparatus includes a tracking device which is controlled ~~in dependence~~ based on the variation ~~in respect of~~ with respect to time of the relative position of the light source and the receiver, preferably ~~in dependence~~ based on the position of the sun.

[003] Optical apparatuses ~~of that kind are known from a practical context for use~~ that track the direction of sunlight are used in solar installations. They are associated with the solar elements, to make the most efficient possible use of the sunlight; in order to ~~feed~~ direct the incident sunlight on to the solar element on an angle as close to ~~in as~~ perpendicular ~~a direction~~ as possible. In the practical context of solar engineering, ~~that purpose is generally served~~ this is accomplished by using focusing systems with lenses and parabolic mirrors, which suitably deflect and concentrate the light. In order to achieve ~~a respective~~ an optimum effect, ~~those~~ these systems ~~are caused to~~ track the movement of the sun. ~~That~~ This requires large and expensive tracking devices ~~of an expensive structure~~, which precisely ~~track~~ control the position of these generally bulky and heavy optical

apparatuses.

[004] A press release in the newspaper "Frankfurter Allgemeine Zeitung," supplement No. 144 of 28th July 1994, contained a report about the use of holographic foil for applying sunlight to solar cells. The holographic foil is intended to replace conventional prisms and lenses. The foil ~~is intended to provide for dividing~~ divides up the light spectrum ~~in order to supply the light~~ and directs the divided up ~~in that way~~ light to solar cells, which are specifically designed for the respective spectral range.

[005] DE 31 41 789 Al discloses a sun ray concentrator having a body which is in the form of a prism and ~~which~~ has a material layer with a hologram structure on the entrance face and on the reflection face ~~has a respective material layer with a hologram structure~~. The parameters of the hologram structure are so selected that the radiation is passed by means of the hologram into the prism ~~and within the prism~~ where it is redirected in such a way that it issues focused at a plurality of end faces of the prism. In that situation, the radiation is concentrated and at the same time the arrangement provides for division into the various spectral ranges, with concentration of the various spectral ranges on the various ray exit faces. ~~The aim is that in that way~~ This allows light to be directed to specific photoconverters ~~can be fed~~ for the respective spectral range. ~~That~~ However, the sun ray concentrator consisting of prisms suffers from the above-described disadvantages in terms of tracking. In addition, because of the prisms, shadow effects occur which reduce the conversion rate.

[006] U.S. No 4,054,356 Al discloses a sun ray concentrator which is in the form of a

hologram of a light spot source. The focal point of the hologram lens, however, is found to be so large that, for the purposes of arranging a receiver for concentrated radiation at the focal point of the lens, an auxiliary device connecting the receiver to the lens is required. In addition, this arrangement involves irregular distribution of energy at the surface of the receiver.

[007] DE 30 12 500 Al discloses a retroreflector for use in light barriers and light curtains. The reflector uses diffraction gratings which are formed by holographic procedures in a photosensitive material. When the reflector is illuminated, the radiation impinging thereon is reflected and focused outside the reflector plate with the hologram.

SUMMARY OF THE INVENTION

[008] The object of the invention is to provide an optical apparatus of the kind set forth in the opening part of this specification, which is of a simple structure and affords the respectively desired light deflection and/or light concentration effect. The ~~aim is that the~~ optical apparatus ~~is to permit~~ provides particularly efficient conversion of light ~~in relation to~~ for uses in solar installations.

[009] ~~In accordance with the invention, to attain that object, it is proposed that an~~ The optical apparatus of the ~~kind set forth in the opening part of this specification is so designed that the optical apparatus has~~ invention includes a transparent or reflective optical body having diffractive and/or refractive and/or holographic regions. In ~~this case in accordance with feature~~ a first embodiment, "combination (a)," ~~combination a) it can~~

~~be provided that~~ the optical body has portions of a different nature ~~in respect of~~ with respect to one or more of its optical parameters along the tracking direction. ~~and that the~~ The different portions of the optical body can be brought into and out of the operative position by the action of the tracking device on the optical body and/or the receiver. The tracking device controls the ~~with~~ relative ~~movement~~ position of the optical body ~~and~~ with respect to the receiver. In a second embodiment, "combination (b)," ~~accordance with feature combination b) it can be provided that~~ the optical body is in the form of a foil and/or is on a foil, which can be tracked by way of the tracking device. The tracking device controls the with relative ~~movement~~ position of the optical body with respect to the receiver by rolling up and unrolling the foil.

[010] ~~Precise tracking can be implemented in a particularly simple manner by virtue of the fact that in~~ In accordance with combination (a), the optical body includes different regions selected from diffractive regions, refractive and holographic regions, ~~having diffractive and/or refractive and/or holographic regions has~~ which have portions of a different nature in terms of ~~its~~ their optical parameters. This allows precise tracking to be implemented in a particularly simple manner. The tracking device which acts on the optical body and/or on the receiver produces a relative movement between the optical body and the receiver. ~~In that situation a~~ The tracking movement ~~occurs, in which~~ causes the different portions of the optical body to move successively into the operative position. ~~In that situation, the~~ The portion of the optical body, which ~~in each case is at the time~~ is in the operative position, ~~forms the portion which is respectively operative at that time and which feeds~~ directs the light incident at that time on to the receiver at the desired irradiation angle

or with the desired concentration.

[011] ~~If in accordance with~~ In combination (b), the optical body is in the form of a foil and/or is on a foil, which can be rolled up and unrolled by way of the tracking ~~device,~~ device. ~~that affords~~ This design provides fundamental advantages in terms of simplicity of structure and costs.

[012] Particular advantages are enjoyed ~~in terms of uses~~ when the invention is used in solar installations. The receiver is in the form of a solar element which can remain stationary while the position of optical device is ~~caused~~ controlled to track the position of the sun. Corresponding advantages are enjoyed ~~in relation to uses~~ when the invention is used in hothouses.

[013] The body of the optical apparatus, which ~~has diffractive and/or refractive and/or holographic regions~~ includes different regions selected from diffractive regions, refractive regions and holographic regions, ~~has a~~ preferably has a flat light entrance face and ~~an also preferably~~ a flat light exit face. The sunlight impinges on the light entrance face at a given angle of incidence ~~in dependence~~ depending on the instantaneous position of the light source relative to the ~~receiver,~~ receiver. ~~that is to say, in~~ In solar installations, ~~in dependence~~ the angle of incidence depends on the position of the sun. The ~~light~~ incident light ~~in that fashion~~ passes through the body and ~~in so doing~~ is deflected or concentrated so that the light issues from the body at the light exit face and is passed to the receiver at a given exit angle or with a given concentration ~~and is thus passed to the receiver~~. The optical parameters of the body are ~~so~~ selected ~~that the~~ to provide a desired exit angle ~~desired~~

~~for the respective use~~ or ~~the desired~~ concentration ~~is obtained~~. ~~In relation to uses~~ When the invention is used in solar engineering applications, the optical parameters of the body ~~are such that the~~ provide an exit angle ~~required to make~~ that makes optimum use of the sunlight ~~from the body and~~ by directing the sunlight ~~corresponding~~ ~~irradiation angle~~ on to the solar ~~element,~~ element at the most efficient irradiation angle. Preferably, ~~as far as possible~~ an irradiation angle of 90°, or maximum concentration, is achieved.

[014] The portions of the optical body, which differ in terms of their optical parameters, can be arranged on or in the body in mutually juxtaposed relationship in the tracking ~~direction,~~ direction. ~~in which respect the~~ The portions can be in the form of portions which blend continuously into each other or in the form of separate discrete portions. An arrangement with a continuous transition of the portions affords advantages ~~in regard to~~ in applications that use continuous tracking. Particular advantages in that respect are achieved if the variation in the optical parameters in the tracking direction is also continuous with a steady progression.

[015] In preferred embodiments, the optical body or the foil has at least one region in layer form, with a light diverting and/or concentrating structure. The optical body can be provided with holographic elements, for example the body may have a preferably layered region having a hologram structure. The portions which differ in terms of the optical parameters may be implemented by the portions having different hologram structures. Instead of or in addition to the hologram structure, the optical body may have a structure of a diffractive lens or a diffractive mirror, which is used to ~~in order~~ substantially ~~to~~

concentrate the light. In order to ~~minimise~~ minimize reflection losses at the optical body or the foil, the optical body or the foil can be de-reflected on the side which ~~is~~ faces towards the light source.

[016] The body can be in the form of a rigid or flexible body. Particular advantages are attained when using a holographic foil. The foil can also be in the form of a concentrator foil with the structure of a diffractive lens or a diffractive mirror. The foil may have a plurality of regions involving different lens structures or different mirror structures, those regions being arranged in succession in the tracking direction.

[017] Tracking can be implemented in a particularly simple manner ~~if it is provided that~~ by associating the regions of the foil which are different along the tracking direction ~~are associated~~ with at least one solar element. In this embodiment of the invention, ~~insofar as~~ a first one of the regions co-operates for a first period of time of one or more days with a solar element and a second region of the foil which is adjacent to the first region co-operates for a subsequent second period of time of one or more days with the solar element. For that purpose, the foil may have regions which can be associated with the individual days of a year or half year, preferably 365 or 182 or 183 different regions.

[018] In the case of larger solar installations having a large number of solar elements, a particularly simple structure is afforded if it is provided that a plurality of solar elements are arranged in longitudinal and transverse rows in a grid arrangement and/or the optical body has a plurality of separate regions which are arranged in longitudinal and transverse rows in a grid arrangement, preferably in a corresponding grid arrangement to the solar elements.

To implement tracking for compensating for the variation in the position of the light source, ~~it can be provided that~~ the grid arrangement of the solar elements and/or the regions of the optical body is turned through an acute angle relative to the tracking direction and/or the direction of movement of the optical body. Tracking with compensation for the variation in the position of the sun over the course of the year can be achieved if an angle of 0.25° is adopted.

[019] If spectral division of the light occurs at the foil, preferably when the sunlight passes through the holographic foil, ~~it is possible to use~~ spectrum-specific solar cells can be used. ~~It is possible for a~~ A plurality of such spectrum-specific solar cells ~~to be~~ are arranged in mutually juxtaposed relationship ~~and for~~ so that the individual light spectra ~~to be~~ is fed to the respective solar cells.

[020] When using a flexible foil, ~~it is possible to provide for design configurations of~~ the tracking device can be configured as ~~device, which are of~~ a particularly simple structure ~~and which in that respect operate~~ that operates reliably and precisely. The tracking device can be in the form of a foil transport device having at least one foil storage device which receives and/or delivers the foil, preferably a drum. Preferably, there is a first drum which winds ~~on~~ up the foil during tracking and a second drum which unwinds the foil during tracking. In ~~that case~~ this embodiment, a foil portion is arranged, preferably in a tensioned condition, between the first and second ~~drums,~~ drums and includes ~~the foil portion having~~ the ~~respectively~~ operative portion of the light guide and/or light concentrator device. ~~For implementing~~ To implement tracking, the first drum is driven in rotation by way of a motor drive. The second drum runs synchronously therewith.

[021] In particular arrangements of the tracking device, there is provided a first transport device which moves the optical body along its main extent. In addition, there can be provided a second transport device which moves the optical body at an angle, preferably at a right angle, with respect to its main extent, or which moves it rotatably about an axis parallel to its main extent. The first or the second transport device is controlled in dependence on the time of day, that is to say in dependence on the position of the sun at the time of day. The other transport device is controlled in dependence on the time of year, that is to say in dependence on the position of the sun at the time of the year.

BRIEF DESCRIPTION OF THE DRAWINGS

[022] Further details, features and advantages will be apparent from the description hereinafter of a number of embodiments diagrammatically illustrated in the drawing in which:

[023] Figure 1 is a diagrammatic view of a solar installation,

[024] Figure 2 is a simplified ~~stylised~~ stylized representation of the solar installation of Figure 1 with the position of the sun in the morning,

[025] Figure 3 is a simplified ~~stylised~~ stylized representation of the solar installation of Figure 1 with the position of the sun at midday,

[026] Figure 4 is a simplified ~~stylised~~ stylized representation of the solar installation of

Figure 1 with the position of the sun in the afternoon,

[027] Figure 5 is a simplified ~~stylised~~ stylized representation of a solar installation with a foil with a diffractive lens, in the form of a concentrator, with the position of the sun at midday,

[028] Figure 6 is a simplified ~~stylised~~ stylized representation of the solar installation of Figure 5 with the position of the sun in the afternoon,

[029] Figure 7 is a simplified ~~stylised~~ stylized representation of a solar installation with a plurality of solar elements,

[030] Figure 8 shows a foil with lenses in a grid arrangement,

[031] Figure 9 is a simplified ~~stylised~~ stylized representation of a solar installation using the foil of Figure 8, and

[032] Figure 10 is a simplified ~~stylised~~ stylized representation of a solar installation with a foil with a diffractive concave mirror, in the form of a concentrator.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[033] The solar installation in Figure 1 has a solar element 1. The solar element 1 can be an individual solar element or ~~also~~ it can be a battery of solar elements arranged in mutually juxtaposed relationship. The solar element 1 can be in the form of a photovoltaic solar cell or a heat-generating solar collector. The sunlight 2 which is irradiated on to the solar element 1 is converted by the solar element 1 into electrical or heat energy. The energy

produced is fed at the output 1a of the solar element into a network (not shown) or an energy storage arrangement.

[034] Associated with the solar element 1 is an optical apparatus 3 which passes the sunlight 2, which is incident at the angle α in dependence on the position of the sun, on to the surface of the solar element 1. The optical apparatus 3 directs the sunlight 2 on to the surface of the solar element 1 at an angle as ~~perpendicularly~~ perpendicular to the surface of the solar element 1 as possible in each case, in order to make the most efficient possible use of the sunlight.

[035] The optical apparatus 3 has a diffractively and/or refractively operating optical body 4 through which the sunlight 2 passes and which ~~in that case~~ deflects the sunlight 2. In the illustrated embodiment, the optical body 4 is in the form of a transparent holographic foil which is tensioned at a ~~spacing~~ distance above the surface of the solar element 1.

[036] The hologram structure of the irradiated portion of the foil 4, which is arranged above the solar element, is such that the sunlight 2 which is incident on the surface of the foil 4 at the angle α, is deflected on passing through the foil and issues at an angle β at the underside of the foil. The arrangement of the solar element 1 is so selected that the sunlight issuing at the angle β is directed at an angle of preferably 90° on to the surface A of the solar element 1. In the illustrated embodiment, the exit angle equals 90° (β = 90°) and the foil is tensioned in a plane parallel to the surface A of the solar element 1.

[037] In order to provide ~~that~~ efficient use ~~is made~~ of the sunlight 2 at any position of the sun, the optical apparatus 3 has a tracking device 5 ~~with~~ which changes the position of the

foil 4 ~~is caused~~ to track the position of the sun relative to the ~~stationarily arranged~~ stationary solar element 1. The tracking device 5 has two synchronously driven drums 51, 52. The first and second drums 51, 52 are arranged parallel to each other at a mutual spacing. They are each rotatably supported in ~~stationarily arranged~~ stationary mounting pedestals 51g, 52g. The foil 4 is tensioned between the drums 51, 52, with the two opposite ends of the foil 4 being wound on the drums 51, 52. The drums 51, 52 are driven in a controlled manner by motor means in such a way that they rotate synchronously about their drum axis 51a, 52a. The direction of rotation in Figure 1 is in the clockwise direction so that the foil 4 which is tensioned between the drums 51, 52 is transported from left to right in the direction C. The speed of the transport movement is controlled ~~in dependence on~~ based on the variation ~~in terms~~ of the ~~time of day of the~~ position of the sun during the day.

[038] During ~~that~~ the tracking procedure, the foil 4 moves continuously in the direction C. ~~In that situation the~~ The foil is wound on to the second drum 52 and unwound from the first drum 51. Only the ~~respective~~ foil portion which is disposed ~~at the time~~ in the tensioned portion above the solar element 1 at any particular time has the incident sunlight passing therethrough and only that portion is ~~in fact~~ operative at the time.

[039] Along its main extent, that is to say in the direction of its surface and thus in the tracking direction C, the foil 4 has a varying hologram structure. The variation in the parameters of the hologram structure is ~~so~~ selected so that, with a given predetermined speed of transport or tracking movement, continuous adaptation of the light deflection effect to the angle of incidence α (which is dependent on the position of the sun and the foil 4), is attained. The adaptation of the hologram structure is such that the exit angle β is

approximately constant in the course of the day with the angle of incidence α which is dependent on the position of the sun. That means that the angles β and γ (the angle of incidence for the light at the surface of the solar element 1) are approximately constant in the course of the day at any position of the sun. ~~and thus~~ Thus, the sunlight is ~~equally~~ efficiently used at any position of the sun.

[040] In order to provide for adaptation in terms of the time of year, tracking is additionally provided ~~in respect of~~ for the angular position of the plane of the foil 4 with respect to the surface A of the solar element 1. In this ~~case~~ embodiment, the plane of the foil is pivoted, preferably together with the drums 51, 52, about a pivot axis ~~arranged~~ that extends parallel to the surface of the solar element in the direction C. ~~In this case, it is provided that the~~ The drums 51, ~~51~~ 52 ~~involve~~ are provided with suitable angular tracking by ~~way of~~ a pivoting mechanism (not shown) which, for example, is arranged in the region of the mounting pedestals 51g, 52g.

[041] The rotary drive for the drums 51, 52 for the above-described tracking of the foil in the direction C, ~~in respect of~~ with respect to the time of day, is ~~afforded by way of~~ provided by separate drive motors 51m, 52m. The drive motor 51m drives the drum shaft 51a. For that purpose, the drive output shaft (not shown) of the drive motor 51m is coupled to the drum shaft 51a by way of a transmission (not shown). The drive motor 52m drives the drum shaft 52a in a corresponding manner. The two motors 51m, 52m are controlled synchronously. The control system ~~is of such a nature that~~ controls the transport speed, that is ~~to say~~ the tracking of the foil 4 in the direction C, ~~takes place in dependence~~ based on the variation in the position of the sun, ~~in respect of~~ with respect to

the time of day.

[042] The foil is retracted at night. That is effected by the drive motors running back in the opposite direction and the foil being unwound from the second drum 52 and wound on to the first drum 51.

[043] The pivotal movement of the drums 51, 52, which is required for tracking in terms of the time of year, can also be effected by motor means, by way of a drive motor (not shown) which actuates the above-discussed pivoting mechanism in a suitably controlled fashion.

[044] ~~While, in~~ In the ~~described~~ embodiment described above, it was assumed that there was a substantially continuously varying, light-deflecting hologram structure on the foil or the transparent optical body and, accordingly, that the foil performed a continuous movement over the solar ~~element,~~ element. ~~it~~ It will be appreciated that it is also possible for the optical body to be provided in a quasi discontinuous manner with a corresponding, light-deflecting structure, for example in the form of stripes of the same ~~structure,~~ structure. ~~in which case then~~ In this embodiment, the optical body would have to be moved in a correspondingly discontinuous or step-wise manner with respect to the solar element.

[045] The embodiment shown in Figures 5 and 6 also involves a solar installation with a diffractive foil which is guided over a solar element 1. ~~and which is caused to track~~ A tracking device 5 controls the position of the diffractive foil so that it tracks the position of the sun ~~in terms of~~ with respect to the time of day by ~~being wound on and off by way of a~~

~~tracking device 5 with~~ winding the diffractive foil on and off the drums 51, 52. The drums 51, 52 ~~which~~ are only diagrammatically indicated and ~~which in actual fact~~ they are substantially larger than shown in the figures and ~~which~~ are mounted at a suitable spacing from each other. Unlike the preceding embodiments, the foil 4 used in Figures 5 and 6 is a foil which concentrates the incident sunlight. This involves a foil concentrator in the form of a diffractive lens 4a. On passing through the lens 4a, the incident sunlight is concentrated so that the image of the sun appears in the solar element 1 arranged at the focal point. When using a foil with a lens diameter of between 1 and 5 cm, the spacing of the foil 4 relative to the surface A of the solar element is between 10 and 20 cm.

[046] During the day, the foil 4, which is tensioned above the solar element 1, is displaced by the tracking device 5 from left to right in the Figures, that is ~~to say~~ in the East-West direction. ~~In that way~~ This displacement of the foil 4 allows the image of the sun, which shines down ~~more or less inclinedly over the course of the day in dependence on the position of the sun in terms of~~ at different angles according to the time of day, ~~is caused to track so that throughout the entire day the image of the sun falls~~ to continuously fall on the stationary solar element 1, ~~which is arranged in a constant position.~~ Figure 5 shows the position of the foil 4 with the angle of incidence of the sunlight 2 ~~being incident in~~ approximately perpendicular to the surface of the foil 4, which would be the relationship at the midday time. Figure 6 shows the position of the foil 4 with the sunlight 2 at an inclined angle of incidence, which would be the relationship ~~being incident inclinedly~~ in the afternoon. As can be seen from Figure 6, ~~in that~~ when the direction of sunlight 2 forms an inclined angle of incidence, the position of the foil 4 or the lens 4a is caused to track by displacement towards

the right.

[047] The transport speed of the foil 4 for ~~the purposes of~~ tracking ~~in terms of~~ with respect to the time of day is f x 0.25 per hour, wherein 'f' is the focal length of the lens. ~~In that way~~ This tracking speed takes into consideration the change in the angle of light incidence, which occurs by virtue of the variation in the position of the sun in terms of the time of day and which is about 15° per hour ~~is taken into consideration~~ and ~~the result is~~ results in precise tracking ~~in respect of~~ with respect to the time of day.

[048] In modified embodiments, a plurality of solar elements 1a, 1b are arranged in succession in the direction of movement of the foil 4. Figure 7 shows such an arrangement of two solar elements 1a, 1b. The foil 4, which is tensioned above the solar elements 1a, 1b, has two lenses 4a, 4b which are arranged in succession in the direction of movement C of the foil. As can be seen from Figure 7, the lens 4a is associated with the solar element 1a and the lens 4b is associated with the solar element ~~1b,~~ 1b; ~~by~~ the lens 4a ~~illuminating~~ illuminates the solar element 1a and the lens 4b ~~illuminating~~ illuminates the solar element 1b. ~~For that purpose the~~ The spacing ~~s~~ S of the solar elements 1a, 1b is equal to the spacing between the ~~centre~~ center lines of the lenses 4a, 4b. Due to the tracking movement of the ~~foil 4,~~ foil 4 according to the time of day, the image of the sun ~~is caused to perform a tracking movement with~~ tracks the position of the sun at the respective time of ~~day,~~ day. ~~so that~~ As a consequence, the image of the sun is continuously incident ~~in each case~~ through the lens 4a ~~in~~ to a constant position on the solar element 1a and through the lens 4b ~~in~~ to a respective constant position on the solar element 1b.

[049] In the embodiments of Figures 5, 6 and 7, a plurality of solar elements 1a, 1b and so forth may be ~~respectively~~ arranged in mutually juxtaposed relationship in one or more rows transversely with respect to the direction of movement of the foil. When using foils with annular lenses, ~~for that purpose~~ a plurality of lenses 4a, 4b and so forth are arranged on the foil in the transverse direction. The lenses and the associated solar elements of a transverse row are respectively arranged in such a way that the spacing between the ~~centre~~ center lines of adjacent lenses is equal to the spacing of the associated adjacent solar elements. In that way, a respective lens of a transverse row is associated with each solar element of a transverse row. ~~In that case, the~~ The tracking movement of the foil 4, ~~in respect of~~ with respect to the time of day, ensures that each solar element is in each case illuminated permanently during the day by way of the lens associated therewith.

[050] Figure 8 shows a foil portion with lenses 4a, 4b, 4c arranged in a raster or grid arrangement on the foil. The lenses are arranged in mutually juxtaposed relationship in longitudinal and transverse rows which extend at a right angle to each other. In ~~that case,~~ ~~that~~ this embodiment, the grid arrangement is turned through an angle of about 0.25° with respect to the direction C in which the foil 4 moves and extends. The angle of 0.25° corresponds to the daily change in the angle of the sun with respect to the solar panel; that change in angle is 47°/182 per day. In that way, it is possible to compensate for the daily change in angle of the sun merely by displacement of the foil in the direction C, that is to say without additional adjustment.

[051] Figure 9 shows the use of ~~that~~ the foil 4 shown in Figure 8 in a solar installation. The foil is tensioned above the solar elements 1a to 1f arranged in a grid arrangement and is

wound on and unwound in the direction C, that is in the East-West direction. In this case, tracking ~~in respect of~~ with respect to the time of day takes place as in the preceding embodiments by displacement of the foil in the course of the day from left to right, as shown in Figure 9. ~~In that case, throughout~~ Throughout the entire day, there is always a respective lens associated with a given solar element so that the solar element is illuminated through that respective lens. For tracking purposes ~~in respect of~~ with respect to the time of year, the foil is displaced by a line spacing each day so that ~~therefore~~ each solar element is illuminated by a lens for only one day. On the following day, the adjacent solar element is illuminated through the following lens. The tracking effect is positively produced upon movement of the foil in the direction C, by virtue of the grid arrangement being turned through the angle of 0.25°. For, due to the grid arrangement being turned in that way, with the daily change in the height of the sun ~~in respect of~~ with respect to the time of year above the horizon, relative displacement of the lenses perpendicularly to the direction of propagation is achieved. ~~achieved and thus~~ Thus, the change in the position of the sun, in terms of the time of year, is compensated.

[052] This means that, in the embodiment shown in Figure 9, the tracking action ~~in respect of~~ with respect to the time of day and also ~~in respect of~~ with respect to the time of year is effected by the tracking movement of the foil 4 in the direction C. ~~For that purpose the~~ The foil 4 can have 182 different lenses arranged in succession in the direction of movement and within a year is moved once completely to and fro by way of the tracking device 5, that is ~~to say~~ to the right in the first half-year in Figure 9 and to the left in the second half-year.

[053] In modified embodiments which, unlike Figures 8 and 9, do not have a grid

arrangement which is turned through an angle, tracking ~~in respect of~~ with respect to the time of year can also be effected. This is accomplished by pivotal movement of the plane of the foil about the axis of movement of the sliding motion, or by displacement of the foil in a plane which is inclined with respect to the horizontal and which is towards the sun. When the solar element is arranged on the inclined roof structure of a house, which faces towards the sun, tracking ~~in respect of~~ with respect to the time of year ~~therefore~~ occurs by displacement of the foil parallel to the inclined roof structure, either upwardly or downwardly.

[054] In the modified embodiment shown in Figure 10, the ~~foil 4, in place of the diffractive lens,~~ foil 4 has a ~~diffractive mirror, a~~ diffractive, concave mirror 4s in place of the diffractive lens. The solar element 1 is arranged on the side of the foil 4, which is towards the sun, at a spacing f (where f = focal length) in relation to the foil 4. The sunlight which is incident on the mirror 4s is concentrated so that the image of the sun falls on the surface A of the solar element. In a corresponding manner to the preceding embodiments, tracking of the foil is effected by way of a tracking device 5, by displacement of the foil in the direction C. The mirror foil may also have a plurality of mirrors 4s arranged in longitudinal and transverse rows. The foil ~~in that respect~~ can be of a corresponding structure to the foils with a lens structure, which have been described with reference to the embodiments of Figures 5 to 9. Embodiments similar to Figures 4 to 9 are possible with the mirror foils.

[055] The heightwise profile of the diffractive lenses and mirrors used in the described embodiments comprises concentric zones of spherical and paraboloidal cross-sections. Instead of or in addition to those concentric structures, the foils 4 may also have

transverse structures. The foils may also be operative to deflect and concentrate light at the same time.

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